MASS GIS Data Viewer *Student Training*

Focus: Conservation/Recreation…Trails

Watershed Perspective ***Lesson #5***

Introduction

Social Studies
Mathematics
Language Arts
Science

"Long Distance State Trails – Proposed Trail Access Areas"

Background: In Lesson #4 you explored the location and distance characteristics of eight Long Distant State Trails in Massachusetts. When a trail is selected for improvement and maintenance, the trail must be divided into sections to facilitate completion of work.Various "work crews" are assigned to these trail sections based on the number of people in the crew, the length of the trail, and various complex characteristics.

Problem: The DEM has asked you to make a draft map using the MassGIS Data Viewer showing possible places where the Midstate Trail could be divided and assigned to various work teams. Your map should show the names of state roads, and the work sections should be identified by a number code and approximate distance in miles. In making the draft map, the DEM has asked you to consider the following criteria:

- Trail work sections should be between 1-4 miles in length.
- All trail work sections must be accessible from a state road
- The view should consider all rare species habitat areas within 200 feet of the Trail.
- Key infrastructure such as "transmission lines" and railroads should also be shown on the map.
- DEM has determined from past work projects, that a crew of 6 people are needed to clear one mile of trail in one week.

Your Task: Use the MassGIS Data Viewer to make a draft map based on the DEM criteria listed above. You will also need to complete a Data Sheet that displays additional information about your map. For each proposed trail work section, you will need to write a brief paragraph describing the best access.

DEM Questions:

1. List the names of the major highways involved in the Trail sections for the selected communities.

2. Are there any transmission lines that cross the proposed trail section work areas?
3. Are there any railroads that cross the proposed trail section work areas?
4. What types of additional information do you feel would be helpful in assessing the difficulty of the trail sections for crews clearing and maintaining the trails?
5. Do there appear to be any "rare species habitats", rivers or ponds within 100 to 200 feet of the proposed trail work areas?

Mass Data Viewer Skills:

- *Adding Feature Themes to a View*
- *Setting View Properties (Map Units, Distance Units)*
- *Working with Tables (Sorting, Query)*
- *Using the Scale Bar (scaling, x,y, coordinates)*
- *Legend Editor (Legend Type, Change Symbol Color)*
- *Using the Palettes (Fill, Color, Pen, Marker, Font)*
- *Labeling Theme Features (Text Label, Text Properties)*

Viewer Buttons and Tools:

- *Select None Button*
- *Open Them Table Button*
- *Measure Tool*
- *Pan Tool*
- *Label Tool*
- *Promote Button*
- *Zoom Into Active Theme*
- *Navigation Tools*
- *Extent Menu Button*
- *Draw Tool*

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Data Viewer Skills

Social Studies
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"Long Distance State Trails -Proposed Trail Access Areas"

Creating a Draft Trail Section Map (Midstate Trail)

1. Beginning the Viewer:

a. Open the MassGIS Data Viewer so the View window contains the theme "MA Towns".

b. Maximize the View Window

2. Changing the Viewer Extent

a. Go to the Menu Bar and click on the "Z button".

b. When the menu appears, scroll through the list and select the Watershed Basins. In the next menu, select "Nashua".

3. Adding Themes:

a. Under the Conservation/Recreation menu, Trails menu, add the theme "Long Distance Trails".

b. Under the Conservation/Recreation menu, National Heritage Data menu, add "Estimated Habitat of Rare Species".

c. Under the Infrastructure menu, Mass Highway Department Roads, add Maj. MHD Rds by class (least detail)

d. Under the Infrastructure menu, add "Trains", "Railroads", and "Transmission lines".

e. Under the Physical Resources menu, Hydrography menu, add Rivers and Streams..major

f. Under the Physical Resources menu, Hydrography menu, add Ponds and Lakes..major

4. Using the Legend Editor (Changing Legend Type, Darkening and Thickening Lines)

a. Double click in the Long Distance Trail area in the View's Table of Contents.

b. When the Legend Editor appears, change the field "Legend Type" to "Single Symbol" instead of "Unique Value".

c. Double click on the line symbol and in the "Pen Palette" change its size to 2.

d. Double click the color palette and change the line color (foreground) to a bright magenta purple. Close the color palette. Click Apply and close the Legend Editor.

e. Double click in the MA Town Boundaries area. Double click the symbol and change the outline thickness to 2. Close the "Fill Palette" and click Apply.

f. With the Legend Editor open, double click the Symbol for the MA Town Boundaries theme. Select and open the Fill Palette and change the theme from transparent to solid. Using the Color Palette, make the foreground white. Click apply, close the color palette and close the Legend Editor.

5. Using the Query Tool to select a Theme Feature (Midstate Trail)

a. Make the Long Distance Trail (LDT) theme active. Under the Theme menu select "query" and do a query to find the Midstate trail in your view. Select "new set". Close the Long Distance Trail query window.

b. The Midstate trail should be selected in the theme table, and also in your View as a yellow color. Check both to see if they are yellow.

Hint: Remember to use the "Promote" button in the Table to move all the selected segments of the line for the Midstate trail to the top of the Table.

c. Use the Pan Tool to move the Midstate trail so it is in the center of the View.

6. Using Theme on Theme to Select Towns Associated with the Mid state Trail.

a. Make the MA Towns Boundaries theme active.

b. Go to the Theme menu and select "Select by Theme".

c. In the "Select by Theme" window, in the first box, choose "intersect". In the second box, choose "Long Distance Trail". Click "New Set"

Hint: Because we have selected the Midstate trail, the Viewer will now select all the towns what contain the Midstate Trail. This same process was used in Lesson #4.

d. In order to see the selected trail against the selected communities, we need to remove the yellow color from the Trail. Make the Long Distance Trail theme active.

e. In the theme menu, select "Clear selection feature". You should not be able to see the Midstate Trail above the yellow communities.

7. Using the On/Off system to simplify your View

a. Often times when working with the Viewer it is not necessary to have all the themes turned on until we actually need them. If you turn them all on, loading the Viewer will be slow.

b. For now, remove any checks (turned on) from the following themes: NHESP, Maj Streams, Maj Ponds, Maj MHD, Railroads, Transmission lines

8. Using the Window "Show Symbol" for Labeling Font and Size

a. Activate the theme MA Towns. Go to the Window menu and select "Show Symbol Window".

b. Click on the "Font Palette", for size select 10, and make the style bold. Click "Create Markers" and close the Palette window.

Hint: At this time we will not change the font type.

c. Go to the "Label Tool" and select the "Call Out Label".

Hint: You will notice there are two types of labeling tools: Label Tool, Text Tool. The "Label Tool" is used when you are taking the names or words that will appear in the View from the active Theme's table. You may use the "Text Label Tool" when you want to type in the name or information to make a label. The "Label Tool" uses the fields from the theme's table as the naming/label source. Both label tool methods can have their font size and style established through the "Show Symbol Window" under the "Window" menu.

d. Examine the Trail, and click on each Town that is traversed by the trail.

Hint: If you have not already done so, be sure the only turned on themes in the View Table of Contents are: MA Towns and the Long Distance Trails.

e. When you place the "Call Out Label" in the community do it so that the name tag appears outside of the community boundary away from the yellow selected color.

Hint: When we turn on the remaining themes, we want to clearly see what is inside the communities where the trail crosses. Name labels might block some of our needed data if they are left inside the trail community.

Only label the communities you can see in your View. Do not use the "Pan Tool" to see all of the Midstate trail communities. ***(1) List the communities in your View that actually intersect the Midstate trail.*** (Data Sheet)

9. Zooming into a Closer Viewer using the Scale Bar

a. As you look at the View Screen, notice that in the upper right corner is a white block with numbers similar to 1:317,972. These numbers represent a ratio and also the scale of your View. (Your scale bar number may not be the same, but it should be close.) ***(2) What does your Scale Bar say for the number ratio?*** (Data Sheet)

b. The first number (1) refers to the number of "units" on the View. The second number (317,972) refers to the number of "units" on the Earth, or we can say on the "ground".

c. Notice that "units" used are not meters, inches, feet, miles, etc. What this means is that whatever "unit" you choose as a measure on the View, will also be the same unit on the ground. Our sample scale above would mean: 1 meter on the View, would be 317,972 meters on the ground. 1 mile on the View would be 317,972 miles on the ground. 1 foot on the View would be 317,972 feet on the ground.

Hint: This is the same type of scaling used on USGS Topographical Maps.

(3) If you had a View scale bar that stated 1:25,000, how could we determine the number of feet 1 inch on the map equals on the ground? (Data Sheet)

d. Try the Scale Bar, by typing in 1:270,000 in its white box. Hit the "Enter" key on your keyboard, and watch the View change to the typed in scale. ***(4) Did the View enlarge or decrease? Does a number of 1:50 mean the View is greater than a scale of 1:100? Explain.*** (Data Sheet) Stay at this scale size.

10. Using the Select Tool to establish our View

a. Make the MA Towns theme active. Go to the Theme menu and select "Clear Selected Features". After you have named all the communities that contain some part of the Midstate trail, select the communities of Westminster and Princeton.

b. Click on the "Select Tool" and move the cursor over the View screen. Click once on each Town you want to use.

Hint: To have both communities selected at the same time, hold down the shift key while you click the "select tool" over the two communities.

The communities you selected should appear yellow.

Hint: If not, it means you must change the MA Towns Theme symbol from transparent to a solid color. Just remember to make the color white so we can see the other theme features as we add them above the MA Towns theme.

c. Now go to your View menu, and select "Zoom to Selected". The view screen should change showing the 2 communities in the center of your view. (Notice the scale bar has changed to a smaller number for the Close up view)

11. Deleting unwanted Graphics and Modifying Others

a. We will now delete the community labels you no longer need. Several options exist. You could go to the Edit menu and select "Remove all Graphics", but we would loose all our community names, and we want to keep the 2 just selected in yellow.

b. Instead make the black pointer tool active by clicking it. Then with the MA Towns theme active, move over the label you do not want and click once to select it. Then use your "delete" key on the keyboard to remove it from the View. Remove only the community name labels that you can see in the Close-up View.

c. Examine the labels remaining for the two communities you selected. If necessary change the label location, or font size. (When you zoomed in, the community names enlarged. This is OK.)

Hint: If using the Label Tool you must have the MA Towns theme active. If using the Text Tool, you will need to type in the community name. Just be sure your spelling is correct. Be sure the "call out" label does not hide any part of the community.

12. Using Theme on Theme Spatial Analysis to locate all State Roads that Intersect the Midstate Trail.

a. In conducting a maintenance program on a long distance trail, it will be important to have a good access to the work area. As stated in the introduction, the DEM suggests that access be from a state road. We will now select the parts of the state roads that intersect (cross over or under) the Midstate Trail in our View. ***(5) Why is access important when working on maintaining a trail, and especially "highway" access?*** (Data Sheet)

b. In some cases this will be very easy to see. But in some communities there are so many state roads finding which ones cross the trail can be difficult.

c. Make the Long Distance Trail theme active, and do a query to select "Midstate Trail" and click "New Set". Close the Long Distance Trail window. When finished the Midstate trail should be yellow in your View.

d. Turn on the Maj. Rds theme and make it active. This will be our "target" theme.

e. Go to the Theme menu and select "Select by Theme". In the "Select by Theme" window, choose "intersect" in the first box. In the second box choose "Long Distance Trail". Click "New Set"

Hint: Remember we have already selected the Midstate Trail. The Viewer will now select all the major highways that cross the Midstate Trail in our View.

f. Make the Long Distance Trail them active. Go to the theme menu and select "Clear Selected Features". The trail will change from yellow to magenta.

g. Make the MA Towns theme active. Go to the Theme menu and select "Clear Selected Features". You can now see the highways that intersect the Midstate trail. The roadways are shown in yellow.

13. Using the Draw Tool to Label Access Points

a. We are making a View of Westminster and Princeton in order to identify possible access locations for the trail maintenance project along the Midstate trail in these specific communities. As we continue, focus only on the communities of Westminster and Princeton. (This same approach can be used in your watershed where a Long Distance Trail exists. You may want to try this for extra practice.)

b. Examine the View and notice the highways in yellow that cross the Midstate Trail in Westminster and Princeton. We will place a triangular marker at each point on the Trail where a highway intersects it. Go to the Window menu and select "Show Symbol Window".

c. In the Palette Window, select the "Marker" icon (thumb tack shape). Click on the black triangle, and set the size to 16. Click on the "Paint Brush" icon and select a bright red color. Close the "Palette" Window.

d. Go to the "draw point" tool, in the Tool bar. Hold down the mouse and select the "dot".

e. Move the cursor (now changes to a cross +) over a section of the Trail where a "yellow" section of the highway intersects the trail in Westminster or very close to the Westminster town line. Click once and a triangle appears. Continue this process until all of the potential access areas in Princeton and Westminster are marked with a red triangle. ***(6) From beginning to end of the Midstate trail in these two communities, how many access points did you identify?*** (Data Sheet)

f. Move the "cross-shaped" cursor over the "pointer" cursor and click once to change it back to a pointer. Use the pointer cursor to click on any marks or graphics you do not want in your View.

13. Naming Roads using the "Graphics" Menu

a. We will use a different technique to name the highways within our View that intersect the Midstate trail. Make the Rds. Theme active.

b. Go to the "Graphics" menu and select "Text and Label Default Tools".

c. In the Text window, begin by selecting the label tool icon we will use. Select the "Bullet Leader Tool" in the second line.

d. Uncheck the box "Use Symbol Window…". Keep the font as listed, and make the color black. In size select 10, and make the style bold. Check use outline, make the outline color black and make the fill color yellow. Click OK.

e. Go to the Tool Bar, and select the "Label Tool". Under the Label Tool options, select the "Bullet Leader Label".

f. Looking at your View, find the yellow selected roads that lead in to the red triangles. Place the tool icon over the road. Click once and drag towards your right.

Hint: To make our final View more readable, keep all label boxes for the roadways to your right as you look at the View.

A small box with a highway number should appear.

Note: In some cases nothing with appear. This is because the roadway is not assigned a name or number by the state. In this cases just leave the roadway unnamed.

g. When finished labeling, convert the "Tool Label" cursor back to a "Pointer" cursor.

Hint: If there are any labels that you do not like their appearance or location, select any them using the "pointer" cursor and hit the delete key on your keyboard. Begin the labeling process again.

h. Make the MHD Rds theme active and go to the "Theme" menu. Select "Clear Selected Features". ***(7) Were there any roads that you could not identify with a state highway number and if so in what communities were they located?*** (Data Sheet)

14. Numbering the Access Triangles using the Symbol Window

a. Go to the Window menu and select "Show Symbol Window". Select the Font Palette (A,B,C icon). In this window, make the size 12, the style bold, and click on "Create Marker". Close the window.

b. Go to the "Text Label Tool" and select "Banner Text".

Hint: Be sure to keep the triangle numbers to the right as you look at the View.

Move your cursor slightly to the right of the first triangle starting from the top of your View. In the window that pops up type "#1". Click OK. Move to the next triangle on your screen, click slightly to the right of it, and type "#2". Continue this process until all the triangles are numbered.

15. Practicing Measuring Distance with the Measure Tool

a. Go to the View menu and select "properties". Change the distance units to miles and do not touch the map units. Click OK.

b. Go to the Tool Bar and select the "Measure Tool". Use the Measure Tool beginning at Triangle #1 moving the tool to triangle #2, and record the distance as you observe it in the lower left of your screen. ***(8) Find the chart in your Data Sheet for measurements, and record the miles between the markers as you tally them with the measure tool.*** (Data Sheet)

Hint: Remember to click once on the first triangle, click again to turn corners, and when you reach the end of the section, read the mileage in the lower left corner of your screen.

You will need to do many small moves and clicks to cover the trail section. Double click to release the measure tool and start over.

c. When all measurements have been calculated and recorded, prepare to type the measurements in a label in your View. All measurements will be typed on the left side of the Trail. ***(9) Use markers that represent the distance within 3 or 4 miles. If two markers are very close, skip one, and use the further one. You will need to calculate these changes in your data chart before you begin actually measuring.***. (Data Sheet)

d. Go to the "Graphics" menu and select "Text and Label Defaults". Select "Call Out Text" icon. Uncheck the "Use Symbol Window…" box. Make the color black, the font size 10 and the style bold. Check off "Use outline". Make the outline color black, and the fill color white. Click OK.

e. Go to the "Text Label" in the Tool bar. Select "Call Out Text". Label on your left as you look at the Trail. Refer to your Data Chart for the correct mileage numbers. Type the mileage in the text window box when it appears and click OK. Continue this until all potential trail sections are labeled with their mileage.

16. Identifying Distances from Sensitive areas by using Spatial Analysis Methods

a. In Massachusetts several environmental laws exist that require individuals and companies to notify local conservation commission if they are working near wetlands, ponds, streams and sometimes, unique wildlife habitat. The maximum distance of concern is proposed (alter, fill, dredge, remove) work within 200 feet.

b. We need to check the Pond & Lakes theme, the Rivers & Streams theme, and the Estimated Rare Habitat Theme for the proximity of the trail maintenance. If we are near these sensitive areas, we will eventually have to meet with the Conservation Commission in the communities and find out if we should file under the Wetlands Protection Act, and/or the Rivers Protection Act.

c. Return to the View Menu and reset the "Properties" for distance units (not map units) to feet rather than miles.

17. Selecting Features using the "Select Features" tool

a. Make the Long Distance Trail theme active. Go to the Tool Bar, and click on the "Select Features" tool. Move the cursor over the Midstate trail in Westminster and click on the trail once. Notice part of the trail becomes yellow.

b. Holding the shift key down, go to the next section of trail and click on it, making it yellow. Continue this process until all of the Trail that passes through Westminster and Princeton is selected.

Hint: Lines used in GIS are done in "arcs" or "segments". Because of this selection of a line will sometimes run beyond a community we are working with. This is OK for our purposes now.

18. Selecting Features Within a Specificed Distance Using Spatial Analysis Techniques

a. Turn on and make the Maj Ponds theme active. Go to the Theme menu and select "Select by Theme". In the upper window, select "Area Distance Of". In the next window that appears type 100 feet.

b. In the lower box, select "Long Distance Trail" and click "New Set".

c. Repeat this procedure for Maj. Rivers…theme using a distance of 200 feet. ***(10) Do you see any ponds that are within 100 feet of the Trail area? (11) Do you see any rivers that are within 200 feet of the Trail area?*** (Data Sheet)

d. Turn on and make the "Estimated Rare Habitat" theme active. Go to the Theme menu and select "Select by Theme". In the upper window, select "Are Within a Distance Of". In the next window that appears type 200 feet. In the lower box, select "Long Distance Trail" and click "New Set".

Hint: Conservation Commissions have jurisdiction within 200 feet from rivers and streams, and 100 feet from ponds and lakes.

e. When the three themes (Ponds, Rivers, Habitat) have been selected using "Theme on Theme" methods, examine the View carefully to identify any of these features that appear yellow.

Hint: Look at your Scale Bar and remember it states 1:some number. If we assume that 1 is a foot, and the other number is the number of feet on the ground. You should realize you will need to look very close at your View to see any selections.

f. Use the magnification Tool to zoom into a river area that is yellow. Make a box with the tool that is very small around the river. What happens to the river area when you zoom in? You may notice that the river does not even show up in your View. Look at your scale bar. If it is below 100,000, the Major River and Pond themes will not appear in your View. The themes for Ponds and Rivers you are using only draw at scales smaller than 1:100,000 (above the number 100,000). ***(12) How can the scale of the data used by MassGIS impact the accuracy of our views and any maps we produce?*** (Data Sheet)

g. Use the "Zoom to Previous Extent" to return to your View.

h. Make the Long Distance Trail theme active, and go to the Theme menu. Select "Clear Selected Features".

19. Using the Draw Tools to Indicate Possible Conservation Commission jurisdiction in your View.

a. Examine the View carefully. If you see a stream that intersects the Trail and is shown in yellow, we need to mark it with a symbol so we can notify the conservation commission about it.

b. Go to the Tool Bar, and select the "Draw tool". Hold down the mouse and select the square/rectangle shaped tool.

c. Find an area in your View that has a pond and/or river in yellow where it is near the Trail in Westminster or Princeton. Holding the mouse down, draw a rectangle or square over the yellow aquatic area. Be sure your square or rectangle is no larger than a penny.

d. Go to the Window menu, select the "Show Symbol Window". Go to the "Fill Palette" and make the outline size 2. Select a fill that is a medium polka dot fill.

e. Go to the Color Palette and select outline. Make the outline red by selecting the color red. Make the foreground red and the background transparent.

f. Continuous this process until all rivers and/or pond sections that appear yellow near the trail have been outlined with a red box. Change your cursor back to a pointer and be sure no graphics are selected in your View.

g. You should notice some "rare habitat" areas are also marked with yellow stripes. We will mark this with a large green circular symbol.

h. Go to the Window menu, select "Show Symbol Window". Select the Marker Tool and pick a solid colored circle with a dot in it as the symbol. Set the size to 20. Go to the Paint Brush icon and open the "Color Palette". Select the color bright green.

i. Return to the Tool Bar menu, select the draw tool, and the dot tool. Move the cursor over the area where habitats are located. Click once for the green dot to appear. Do not block the habitat, but make the symbol off it its side on the left of your View. Return your cursor to a pointer.

20. Using the Draw Tool to mark any areas where the Trail Intersects Transmission Lines and/or Railroads.

a. Any crews that may be working on trail maintenance need to be careful around Transmission Lines and Railroad tracks. Both of the agencies that are in charge of these networks must be notified before any work can begin in these trail areas. Use the skills you have already learned, and determine if any of these types of Infrastructure would be a potential problem in the Trail Maintenance project if it were conducted in Westminster and/or Princeton?

b. Find any of these areas in your View. Mark the trail sections on the left where the trail crosses the infrastructures (transmission lines and/or railroads). Use a square with a dot and make it a bright green at a size 20.

Hint: You many want to turn off some of the themes so you can find these features. ***(13) Did you find trail sections in Westminster and/or Princeton that crossed through Transmission Lines and/or Railroad tracks?*** (Data Sheet)

You have now completed your Data Collection. Proceed by answering the DEM Questions, and making recommendations.

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Data Sheet

Social Studies
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"Long Distant State Trails - Proposed Trail Access Areas"

Name: _____ Date: _____

1. List the communities in your View that actually intersect the Midstate trail

(2) What does your Scale Bar say for the number ratio?

(3) If you had a View scale bar that stated 1:25,000, how could we determine the number of feet 1 inch on the map equals on the ground?

(4) Did the View enlarge or decrease? Does a number of 1:50 mean the View is greater than a scale of 1:100? Explain

a. _____ b. _____

c.

(5) Why is access important when working on maintaining a trail, and especially "highway" access?

(6) From beginning to end of the Midstate trail in these two communities, how many access points did you identify?

(7) Where there any roads that you could not identify with a state highway number and if so in what communities were they located?

a. _____

b.

(8) Find the chart in your Data Sheet for measurements, and record the miles between the markers as you tally them with the measure tool

#1 - #2	_____	Miles
#2 - #3	_____	Miles
#3 - #4	_____	Miles
#4 - #5	_____	Miles
#5 - #6	_____	Miles
#6 - #7	_____	Miles

(9) Use markers that have been combined. You will need to calculate these in your data chart before you begin

__ to __	_____	Miles
__ to __	_____	Miles

(10) Do you see any ponds that are within 100 feet of the Trail area?

(11) Do you see any rivers that are within 200 feet of the Trail area?

(12) How can the scale of the data used by MassGIS impact the accuracy of our views and any maps we produce?

(13) Did you find trail sections in Westminster and/or Princeton that crossed through Transmission Lines and/or Railroad tracks?

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DEM Question Sheet

Social Studies
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"Long Distant State Trails - Proposed Trail Access Areas"

Name: _____ Date: _____

1. List the names of the major highways involved in the Trail sections for the selected communities of Westminster and Princeton.

2. Are there any transmission lines that cross the proposed trail section work areas?

3. Are there any railroads that cross the proposed trail section work areas?

4. What types of additional information do you feel would be helpful in assessing the difficulty of the trail sections for crews clearing and maintaining the trails?

5. Do there appear to be any "rare species habitats", river or ponds within 100 or 200 feet of the proposed trail work areas?

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DEM Recommendation

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"Long Distant State Trails - Proposed Trail Access Areas"

Name: _____ Date: _____

Using the DEM Criteria listed in the Problem, Tell which trail sections as you labelled them in your view would you recommend for maintenance work. Be sure to include a clear description of where each of the sections are located and the best access point. Also identify which systems you would suggest be discussed with the local Conservation Commissions and why? Based on your current information from MassGIS, about how many crews would you recommend for the Westminster-Princeton Midstate trail sections, and what time period would you assume they should be done? Summarize any other data you feel is needed to be more precise assessing potential difficulties that might be occur in clearing and maintaining trails in these central Massachusetts com
munities. (Use data from your Data Sheet)